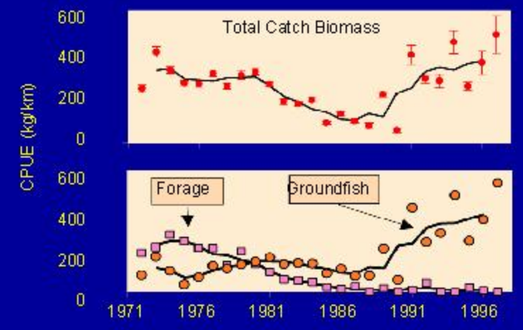
Long-term Changes in the Gulf of Alaska

Small-mesh Trawl Surveys 1953 - 1998

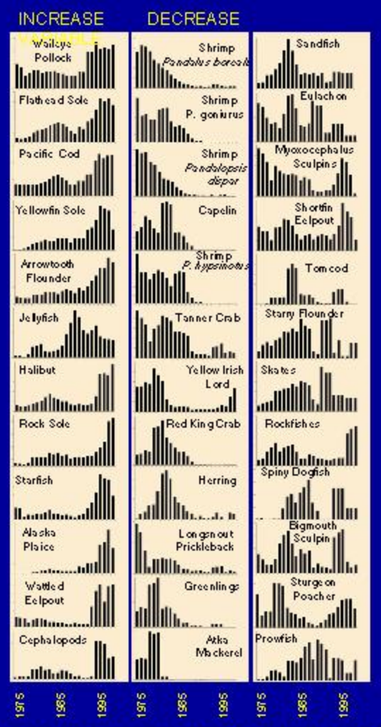
Introduction

Declines of apex predator populations (murres, kittiwakes, harbor seals, and Steller sea lions) have occurred in the Gulf of Alaska since the 1970s. Changes in abundance of forage species may be related to the decline of these predator populations and their chronic low population levels. A shift in ocean climate during the late 1970s triggered a reorganization of community structure in the Gulf of Alaska ecosystem, as evidenced in changing catch composition on long-term (1953-1997) small-mesh trawl surveys. This trophic reorganization apparently occurred at the expense of piscivorous sea birds and marine mammals.

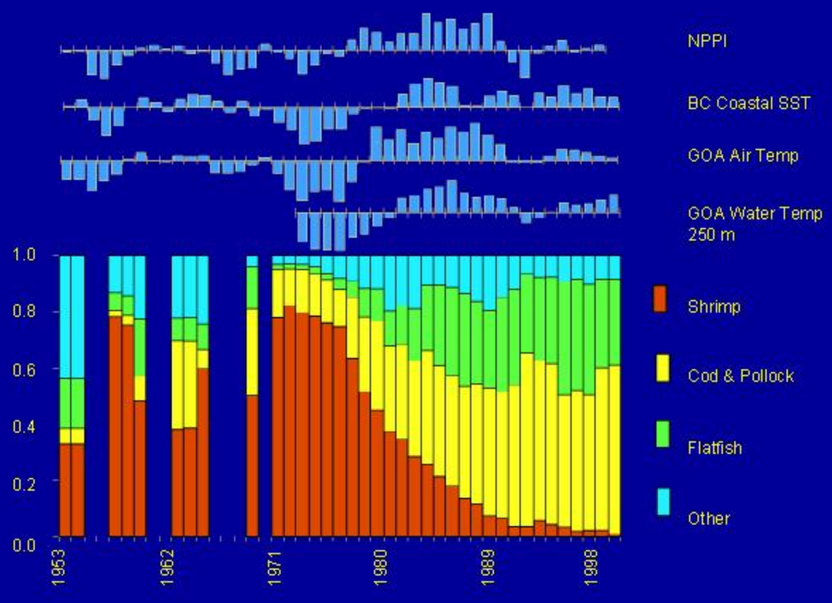
Changes in shrimp survey catches 1970 - 1998



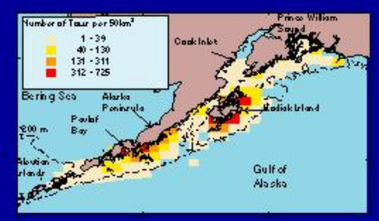
Trends in catch biomass (CPUE) of combined taxa in standardized small-mesh trawls conducted between 1972 and 1997. Upper panel shows catch biomass (± SE) of all taxa, and bottom panel shows separate trends for groundfish (cod, pollock, all flatfish) and forage species (all shrimps, capelin, smelts, sandfish, herring, juvenile pollock <20 cm). Heavy lines show 3-year running averages.



Trends in catch biomass (CPUE) for 36 species caught in standardized small-mesh trawls conducted between 1972 and 1997. Taxa are ranked from highest (top) to lowest (bottom) in abundance for each category (increasing, decreasing, variable). These species account for more than 98% of the total biomass caught in all years.



Composition of small-mesh trawl catches in the Gulf of Alaska between 1953 and 1997 in relation to climate indices. Climate data expressed as normalized anomalies. NPPI is the North Pacific Pressure Index. Trends were smoothed by taking 3-year running averages.



Distribution of small-mesh trawl surveys (n = 8996) in the Gulf of Alaska between 1953 and 1997.

Conclusion

These data present evidence of community reorganization following the 1977 climate regime shift that involved all abundant taxa caught in research shrimp trawls.

The transition from cold to warm-regime community structure lagged temperature changes and required 15-20 years to complete.

Decadal fluctuations in biomass and composition of fish communities apparently had a profound impact on sea birds and marine mammals that subsist on forage species.

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